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COMPLETE SPECIFICATION

Improvements in the Manufacture of Chocolate

We, SOCIETE ANONYME FRANCAISE POUR LA SEPARATION, L'EMULSION ET LE MELANGE (Procédés S.E.M.), a French Company, of 19—21, rue Mathurin Régnier, Paris, France, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

10 The present invention relates to the manufacture of chocolate and more particularly to methods and apparatus for the treatment of chocolate paste, and has for its principal object to lessen the time to which such paste is subjected to the usual conching treatment or wholly to avoid the necessity for such treatment, whilst however freeing the paste from undesirable odours and otherwise rendering it suitable for the production of high-grade chocolate having a range for example between ordinary crisp eating chocolate and extra-fondant chocolate.

The specification of British Patent No. 461,772, of which the present Applicants are the Proprietors, discloses a process and apparatus for producing in a continuous manner, mixtures, emulsions, washings and the like, consisting in admitting one of the phases to be mixed to a surface of revolution rotating at a high speed so that it flows in the form of a continuous thin layer over the said surface under the action of centrifugal force, and admitting another phase to be mixed to another surface of revolution, also rotating at a high speed, so that the second phase, under the action of centrifugal force, is projected, in a high state of atomisation, from the edge of larger diameter of the second cone being revolution into the continuous thin layer of the first-mentioned phase. The apparatus for carrying out the process has the first surface of revolution of conical formation to which the first phase is admitted, and a second surface of revolution, also of conical formation and

mounted for rotation in coaxial relationship with the first cone, the edge of the larger diameter of the second cone being located inside the first cone. If desired, the apparatus may include a series of rotatable conical surfaces of revolution so disposed that the mixture escaping successively from each surface is atomised under the action of centrifugal force and projected on to the next surface so as to produce thereon a new mixture, the final cone if desired being located in a fixed conical surface with a gap between, through which gap the mixture passes and is laminated.

Again, in the specification of British Patent No. 640,564, of which the present Applicants are the Proprietors, there has been described and claimed a homogenising apparatus for a fluid pasty mixture having a conical member with an inner conical surface together with means for rotating the said member, as well as means for feeding the fluid pasty mixture thereto so that it flows freely over the inner surface from the edge of which it is projected centrifugally on to a second conical surface rotating in the opposite direction so that after the reception thereon the said mixture spreads as a thin layer over the conical surface of the second conical member to the outer extremity thereof from which it is projected centrifugally, the said second conical member having a peripheral flange with a double frusto-conical exterior surface co-operating with a stationary outer coned member with an inner conical surface so that the mixture received by this stationary coned member passes between the same and the said double frusto-conical exterior surface. the larger cone of which is slightly spaced from the stationary conical surface to effect a rolling or lamination of the mixture passing therebetween. We do not claim herein anything claimed in Specification No. 640,564.

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In a process for the treatment of liquid cocoa material it has been proposed repeatedly to project such material by means of centrifugal force against a heated surface, and a machine for carrying out the process comprises a hollow conical centrifugal drum open at the top and the bottom and having centrifugal blades on the exterior and interior, the cocoa liquid being fed into the drum and centrifugally projected on to the interior of a heated cup-shaped surface in which the drum rotates so that the material falls to the base of such cup-shaped surface where it is again collected into the rotating drum, the action being repeated as many times as required. As a modification of this apparatus, a plurality of such apparatus in series has been suggested so that the material treated in the first, passes to the second and so on, if desired pumping means being provided to return the finally treated material again to the first apparatus from which it is re-cycled.

It has also been proposed in an apparatus for effecting conching, to feed the paste on to a rotary disc having a plurality of upwardly projecting pins spaced apart radially and circumferentially and arranged in circles, and for these pins to pass between spaces of other similarly arranged but oppositely directed hollow pins held on the base of a fixed container, compressed air being passed through the said hollow pins so that by centrifugal action the paste is dispersed and aerated. Further, the said apparatus includes means by which the paste, after such treatment, is re-cycled to the feed position to come under the action of mixers and to be re-fed for further treatment as many times as required.

In general, as is well known, chocolate paste, for conching, is produced by roasting and crushing the cocoa-nibs and producing a so-called cocoa liquor which is submitted to a primary mixing operation with desired proportions of sugar and, if required, cocoa butter. This is crushed or ground and then mixed in a vat *in vacuo* or otherwise, after which the resulting chocolate paste is ready for conching, that is, stirring in large mixing vats termed conches for a period ranging, for example, from eight to seventy-two hours. Subsequently the conched paste is dried, which may take twenty-four hours or more before it is ready for moulding.

According to the present invention the chocolate paste is subjected to a defined homogenisation, hereinafter referred to as such and consisting of the following successive steps: (a) spread centrifugally into a thin exposed layer, (b) atomised

by centrifugal projection, (c) again spread into a thin layer and (d) laminated between two relatively movable surfaces. (Further such steps are carried out by what herein is termed "defined homogenisers").

This treatment may be repeated as many times as desired and with or without a re-mixing of the treated paste between such treatment.

An apparatus for carrying the above methods into effect comprises a centrifugal homogenizer, such for example substantially as shown and described, but not as claimed in the Specification of British Patent Application No. 37887/46 (Serial No. 640,564).

In addition to the mechanical effects moreover, the paste is submitted during its treatment to a vaporization of the substances that should be eliminated by reason of their undesirable odour and the flavour they give to the chocolate, said vaporization being enhanced through the considerable dispersion which can take place in air or in a vacuum. In addition thereto, the homogenization gives a better distribution of the different constituent elements of the paste with reference to one another, whereby the chocolate may be submitted rapidly to the desired transformation and ageing treatments that could not be executed heretofore except after a sufficiently long passage through the conches. Lastly the lamination step of the defined homogenisation without producing a true crushing of the different components and in particular of the sugar grains produces in practice a rounding of such grains which gives the chocolate a mellowness which is particularly apparent in the manufactured final chocolate even in the case where the sugar used for the manufacture was not originally provided in extremely fine particles.

When it is desired to adapt the method according to the invention to an existing plant including apparatus operating *in vacuo* and conches, it is possible in accordance with the invention to insert an apparatus of the above disclosed type between the apparatus operating *in vacuo* and the conches in order to treat the paste fed by the apparatus operating *in vacuo*, which allows reducing to a considerable extent the duration of the conching treatment itself.

It is also possible in accordance with the invention to arrange in series a plurality of defined homogenizers through which the paste flows in succession, in which case it is possible to omit completely the conching treatment and even the kiln treatment. The paste passing

out of the last said homogenizing apparatus may be either sent directly into the moulding apparatus, or after crushing in a crusher of ordinary type provided with blades, grindwheels, rollers or the like, to remove any trace of aeration in the paste.

It is not necessary for the paste to pass through the vacuum apparatus but it can pass directly from the preliminary mixing crusher to a succession of defined homogenizing means and finally enter a simple mixer from which it is led directly to the moulding means. Further, these operations may be performed in a continuous manner as the defined homogenizers co-operate in a continuous manner and it is thus possible to save considerable time for the different operations and to obviate the major part of the handling required heretofore.

When it is desired to reduce the total bulk of the various apparatus it is also possible, in conformity with the invention to use a single mixer for treating the paste before its passage through the defined homogenizers and the paste passing out of the last said homogenizer.

It is also possible in accordance with the invention to use instead of a series of defined homogenizers, a single such homogenizer inside which the paste undergoing treatment is caused to circulate as many times as required.

It is also possible according to the invention to associate for this purpose in a single machine a mixing apparatus with a defined homogenizing apparatus, the system being if required submitted to vacuum and the paste undergoing, inside said apparatus, different operations: initial mixture before crushing, defined homogenizing, removal of all traces of moisture and undesirable odours, and final mixture.

In order that the invention may be better understood, it will now be described with reference to the accompanying diagrammatic drawings which are given by way of example only and in which:—

Fig. 1 is a diagram showing the adaptation of a defined homogenizing apparatus to existing apparatus.

Fig. 2 is a cross-sectional view showing by way of example, a type of such homogenizer that may be used according to the invention.

Fig. 3 is a diagram showing the invention as applicable to the continuous or substantially continuous production of treated chocolate paste by means of several defined homogenizing apparatus arranged in series.

Fig. 4 is a cross-sectional view of an

arrangement for the production of treated chocolate paste wherein the paste passes several times through the same defined homogenizing device.

Lastly fig. 5 is a cross section of a compound mixing and defined homogenizing apparatus adapted to operate *in vacuo* and ensuring alone all the operations required for the production of chocolate between crushing and moulding.

Referring to fig. 1, 1 designates the vacuum apparatus inside which there is introduced for the usual treatment the paste obtained by the crushing of the primary mixture, while 2 designates the conches and 3 a defined homogenizing apparatus inserted, according to the invention, between the vacuum apparatus and the conche.

This homogenizing apparatus may according to the invention be substantially of the type described in the Specification of the before-mentioned Application No. 37887/46 but not as claimed therein and which herein is illustrated diagrammatically in fig. 2. Said apparatus includes two rotary cones 4 and 5 or a greater number of such cones rotating for instance in opposite directions at equal speeds. The paste introduced through 6 and carried along by a worm 7 is ejected through the opening 8 of the cylinder 9 and slides as a thin exposed layer over the inner surface of the cone 4 which drives it into rotation through the fins 10. It is projected in an atomised form, under the action of centrifugal force, on to the cone 5 on which it then flows as a thin layer driven in rotation by the fins 12 and then centrifugally projected on to a stationary conical surface 13.

During all these operations, the paste is submitted to a considerable dispersion and is transformed finally into an extremely homogeneous mixture.

At the output from the cone 5 and when it impinges against the surface 13, said paste flows between said surface 13 and a rotary surface 14 rigid with the cone 5 and it is submitted between said surfaces 13 and 14 to a crushing and a re-agglomeration before it is finally exhausted through a channel that is not illustrated in fig. 2.

The insertion of the apparatus 3 between the vacuum apparatus 1 and the conche 2 has for its result to give a greater homogeneity to the paste whereby the conching in the conche 2 need only take a short time as disclosed hereinabove.

In the form of execution of fig. 3 the material passing out of the crusher is

introduced, with the further addition of cocoa butter provided for the different grades of chocolate, into the preliminary amalgamating mixers 16 and 17 feeding alternately the first of three defined homogenizing apparatus 3, 3¹, 3¹¹ arranged in series and through which the paste passes in succession while said paste is transferred from one apparatus to the next, for instance, through a worm conveyor or the like means.

These homogenizing apparatus may in particular be of the same type as those described with reference to fig. 2. In such homogenizing apparatus and as a consequence of the atomizing of the paste there is provided an intense evaporation which leads to the disappearance of the undesirable odour and moisture which allows doing away with the vacuum apparatus and with the kilns.

At the output from the homogenizing means 3¹¹, the paste is introduced into a terminal mixer 48 that may be a simple mixer of the usual type and the paste passing out of it may be delivered directly to the moulding means if required after the usual so-called tempering operation.

This arrangement in series of the defined homogenizers allows a substantially continuous production of chocolate, the preliminary mixers 16 and 17 being made use of alternately, one of them being filled while the other is operating.

In the form of execution illustrated in fig. 4, the plant used for production is restricted to a single mixer 18 of the usual type that is adapted to be set under vacuum and to be inserted inside the closed circuit comprising a defined homogenizing apparatus 3, the pipes 19 and 20 and a pump 21 of any type. The operation of this last arrangement is as follows:

There is first introduced into the mixer 18 the complementary amount of cocoa butter after said mixer has been heated so as to bring its temperature to about 50° C. so as to melt the cocoa butter. There is then introduced gradually into the mixer the primary mixture obtained after crushing.

These different components are then mixed for a certain time inside the mixer 18 so as to obtain a first mixture after which the mixer is stopped if desired or allowed to continue rotating and set under the action of vacuum and if required heated so as to assume a temperature suitable for the treatment of the chocolate, say 80 to 90° C., after which the mixture is caused to circulate through the pump 21 into the homogenizing apparatus 3 and finally to return through the pipe 19

into the mixer. This operation lasts for instance until the mixture has passed as a whole at least three more times through the homogenizer 3. The pump is then stopped and the mixer 18 is run for a few minutes so as to stir again the whole mass undergoing treatment. The mass is then in a state allowing it to be moulded.

It is also possible to provide for the simultaneous operation of the mixer and of the homogenizer which in certain cases provides a saving of time.

The apparatus illustrated in fig. 5 allows executing in a particularly simple manner the system of operation that has been described with reference to fig. 4.

This apparatus includes a vat with a double wall at 22, 23 inside which it is possible to circulate either steam under pressure or cold water so as to keep the vat at a temperature approximating 100° C. or to cool it as the case may be. This vat includes a removable cover 24 and at its lower part a closable outlet 25.

It includes moreover if required inspection gates, means for sampling, means for automatic adjustment of temperature etc., and all other members such as auxiliaries for inspection, adjustment and safety that have not been illustrated for the sake of clearness.

Inside said vat is arranged a mixing apparatus including for instance removable blades 26—27 the latter of which are carried by a frame 28 adapted to be urged into rotation by a spindle 29 driven in its turn through the agency of pulleys 30 for instance or by any suitable motor not illustrated.

The inner blades 26 are secured to a hollow axial tube 31 which rotates with the frame 28 by connecting the uppermost blades 26 and 27 and opens at its lower end 32 a little above the bottom of the vat 22. Inside said tube 31 is located a driving worm 33 driven through a spindle 34 coaxial with the axis of the blade system from the pulley 35 and at a speed different from that of the tube 31.

The tube 31 opens at its upper end inside the chamber 34' of the homogenizer which latter is carried by the cover 24 of the vat. The homogenizer is constituted in a manner quite similar to that described with reference to fig. 2 except for the fact that it is driven from above as apparent from fig. 5, instead of being driven from below, through the pulleys 36 and 37 for instance. It should be mentioned moreover that the speed of rotation of the homogenizer should be much greater than that of the blades of the mixer and that the driving means for the two apparatus should be designed

so as to take this fact into account.

The cover is connected moreover with a pipe 38 leading to a vacuum pump not illustrated. Furthermore, 39 designates the carrier feet for the system considered as a whole. The apparatus operates in the following manner:

As in the preceding case, the cocoa butter incorporated by way of addition is first mixed with the already crushed primary mixture while the vat 22-23 is suitably heated by steam or hot water for instance. The cover 24 is then closed and the pipe 38 connected with vacuum.

The homogenizer is then actuated together with the driving worm 33 the rotary speed of which should, as before stated, be different from that of the tube 31 supporting the blades 26. It may be of interest during said operation to keep the blades 26 and 27 of the mixer rotating so as to further the circulation of the paste. The driving worm 33 feeds the homogenizer through the chamber 34 and introduces into it the portion of the mixture coming from the bottom of the vat.

The homogenizing of the paste is continued during a suitable period in a manner such for instance that the whole of the paste passes at least three or four times through the homogenizing apparatus. When this operation is at an end, the homogenizer is stopped and the worm 33 is stopped simultaneously and if required after removal of the cover 24 the blades 26 and 27 are started rotating during the time required for stirring again the mixture as a whole; the mixture is then ready for the moulding means.

Experience shows that the chocolate obtained from paste treated in conformity with the invention is of a grade that is superior to that obtained through the usual method. This chocolate, devoid of any undesirable odour and of any trace of moisture and roughness has a flavour and a mellowness that are far superior while it may be kept for a practically indefinite period of time. Granulometric analysis shows a maximum fineness of 20 to 50 microns which is generally far superior to the results obtained up to the present day.

What we claim, subject to the foregoing disclaimer, is:—

1. A method for treating chocolate paste in substitution, at least partially, for the conching operation, comprising spreading the paste centrifugally into a thin exposed layer, atomising the said layer by centrifugal projection, again spreading the paste into a thin layer, and

finally laminating it between two relatively movable surfaces.

2. A method for treating chocolate paste in substitution, at least partially, for the conching operation, in which the treatment as claimed in claim 1 is repeated as many times as desired and with or without a re-mixing of the treated paste between such treatments.

3. An apparatus for treating chocolate paste in order to obviate or reduce the conching operation, comprising at least two rotatable conical surfaces of which the first is located within the second, means for feeding the paste to the first-named conical surface so that due to the rotation the paste is first spread into a thin exposed layer thereon and then projected therefrom in an atomised state on to the second conical surface on which it is spread as a thin layer to pass therefrom by centrifugal projection to laminating means, for the purposes set forth.

4. An apparatus as claimed in claim 3 in which the laminating means comprises third and fourth conical surfaces having a gap therebetween and one of which rotates with the second conical surface, the arrangement being such that the thin layer of paste passing from the second conical surface enters the gap between the third and fourth conical surfaces, for the purposes set forth.

5. An apparatus as claimed in claim 3 or 4 in which the paste, after the laminating treatment, passes to a mixer and is then returned by pumping means again to be fed to the first conical surface for further treatment, the cycle being repeated for any required number of times.

6. An apparatus for treating chocolate paste in order to obviate or reduce the conching operation, consisting of a plurality of apparatus as claimed in claim 3 or 4, the outlet from each (except the last) being connected to the inlet of the next succeeding.

7. An apparatus for treating chocolate paste in order to obviate or reduce the conching operation comprising, as a unit, an apparatus as claimed in claim 3 or 4 combined with a mixer, the arrangement being such that the paste, after the laminating treatment, passes to the mixer from whence it is fed to the first conical surface, the cycle being effected as many times as required.

8. An apparatus as claimed in any one of the preceding claims 3 to 7 including a suitably disposed exhaust pipe or exhaust pipes in connection with a vacuum pump, for the purposes set forth.

Dated this 26th day of June, 1947.

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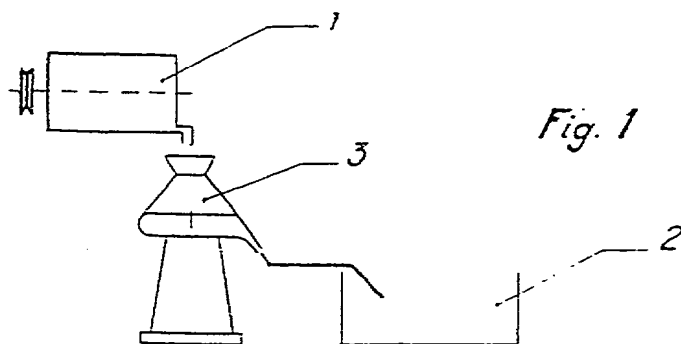


Fig. 1

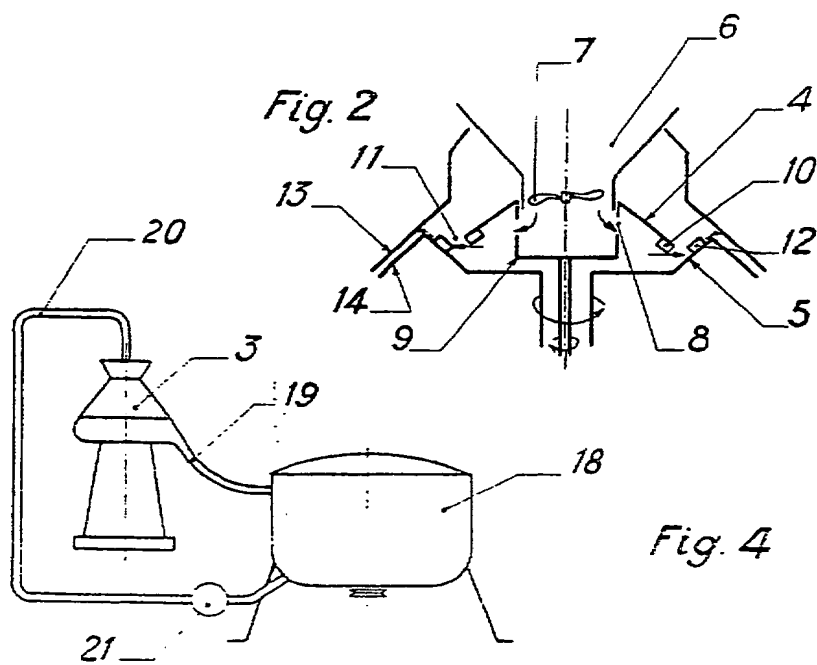


Fig. 2

Fig. 4

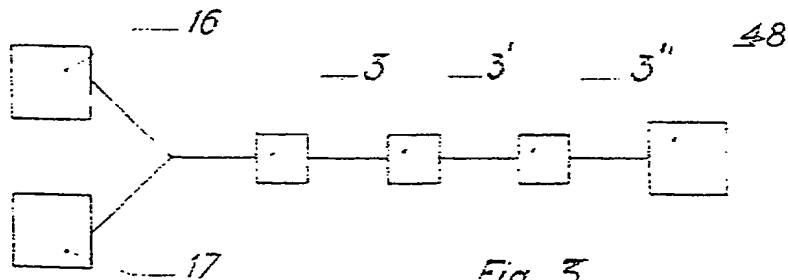
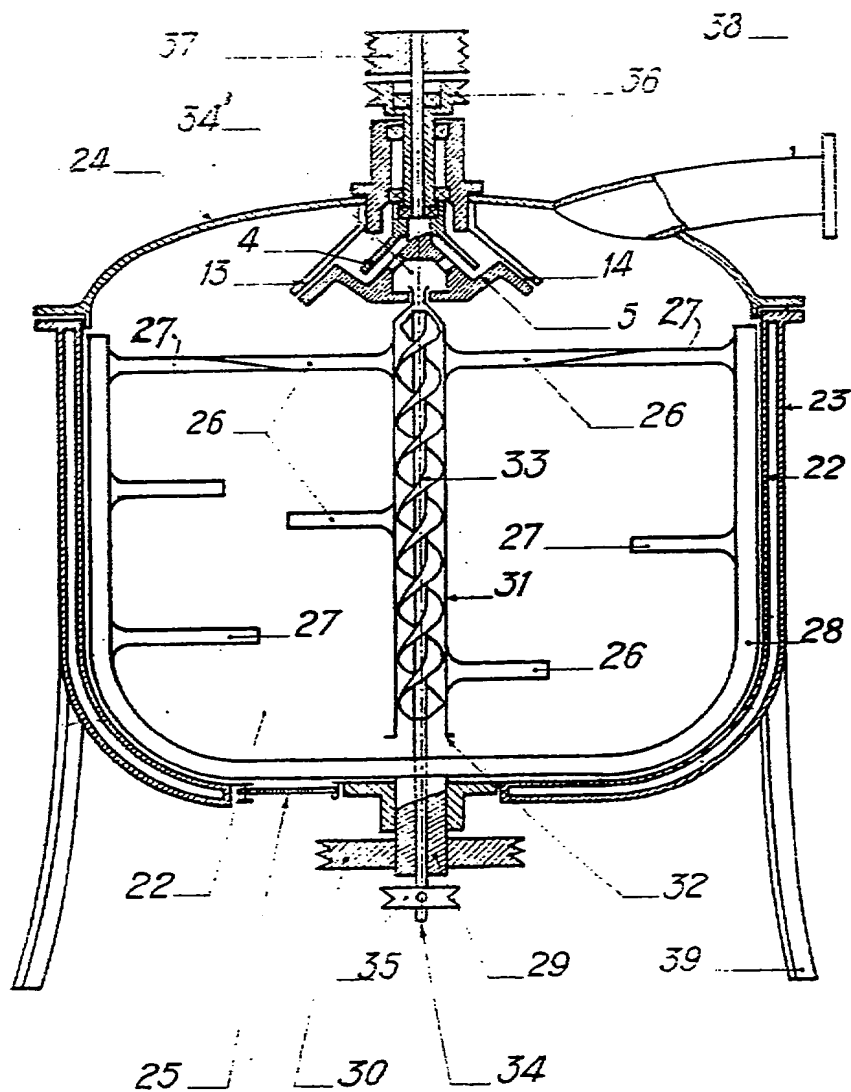


Fig. 3

Fig. 5



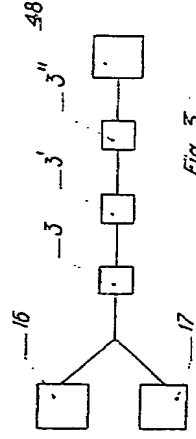
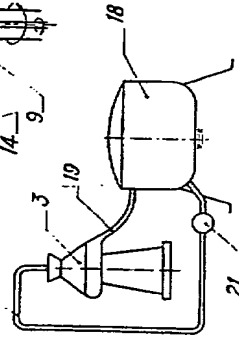
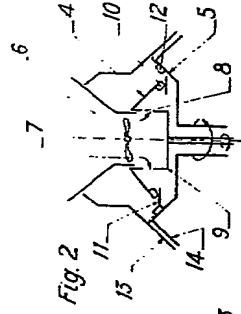
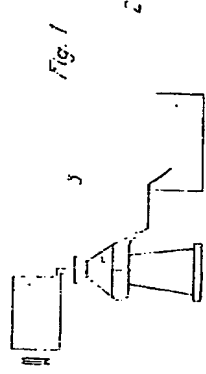
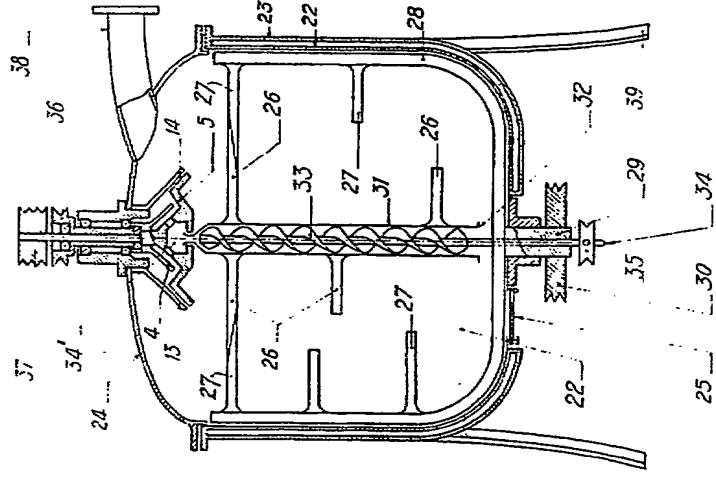


Fig. 5



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